

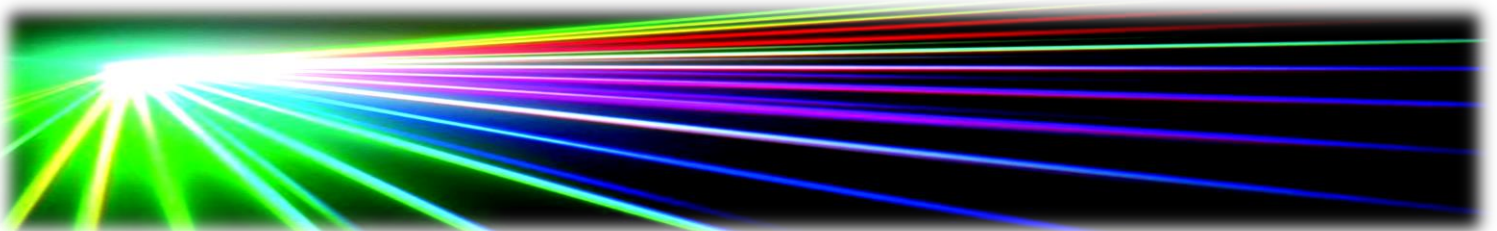
**Harvatek Surface Mount CHIP LEDs Data Sheet
B3D83RGB-05C0001I4U1930**

Features

- Support control circuit to be integrated with RGB chips into a single package
- Support signal reshaping to pass control waveforms to next adjacent ALED
- Cascading port transmission by a single data line
- Support BI backup input data line to prevent data input failure from malfunction DI line
- Maximal R/G/B channel drive current: 5mA
- 256-step gray-scale output to allow 16,777,216-color display
- Support 16-level current gain control for R/G/B channels
- Support sleep and wake up mode (patent granted)
- Built-in power-on-reset (1.7V) (@VDD=5V)
- Built-in brown-out reset (1.8V) (@VDD=5V)
- Operating voltage 3.3~5.5V

Applications

- Gaming keyboard
- Decorative LED lighting
- LED video display



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DISCLAIMER

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HARVATEK's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President of HARVATEK or HARVATEK INTERNATIONAL. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Product Specifications

Item	Specification	Material	Quantity
Luminous Intensity(Iv)	Red : 80~160mcd Green : 180~260 mcd Blue : 30~70 mcd IC@5V, R/G/B@5mA Ts= 25 ^o C; Tolerance ±10%		
Wavelength	Red : 618~625 nm Green : 520~535nm Blue : 460~474 nm IC@5V, R/G/B@5mA Ts= 25 ^o C; Tolerance ±10%		
Applied voltage	5V_DC		
View angle	120 ^o		
Resin	Clear	Epoxy	
Carrier tape		Conductive black tape	4000ea/reel
Reel		Conductive black	
Label	HT standard	Paper	
Packing bag	220x240mm	Aluminum laminated bag/ no-zipper	One reel per bag
Carton	HT standard	Paper	Non-specified

Others:

Each immediate box consists of 5 reels. The 5 reels may not necessarily have the same lot number or the same bin combinations of Iv, λ_D and Vf. Each reel has a label identifying its specification; the immediate box consists of a product label as well.

Note :This is shipped test conditions

※Remarks: This product should be operated in forward bias. If a reverse voltage is continuously applied to the product, such operation can cause migration resulting in LED damage.

ATTENTION: Electrostatic Discharge (ESD) protection

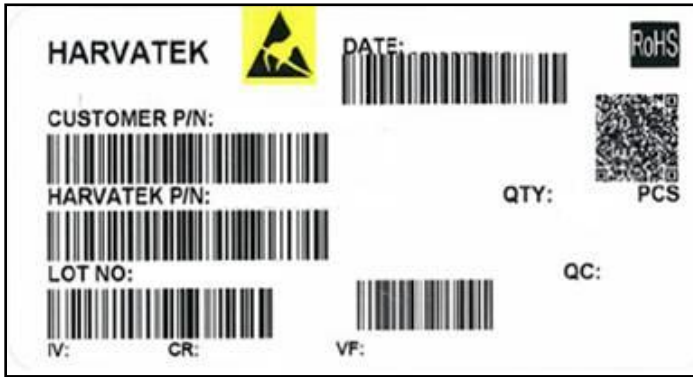


The symbol to the left denotes that ESD precaution is needed. ESD protection for GaP and AlGaAs based chips is necessary even though they are relatively safe in the presence of low static-electric discharge. Parts built with AlInGaP, GaN, or/and InGaN based chips are **STATIC SENSITIVE devices**. ESD precaution must be taken during design and assembly.

If manual work or processing is needed, please ensure the device is adequately protected from ESD during the process.

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Label Specifications



■ Harvatek P/N:

B 3D8 3 RGB- 05C 0001 I4

Product	Package	Dice Qty	Color	Current	Series Number	Taping
PCB	1.08(L)x1.08(W)x0.5(H) mm	3:Tri	RGB RGB(Full Color)	R/G/B:5mA	X001~XZZZ	1.Taping style 2. Qty

■ Lot No.:

1	2	3	4	5	6	7	8	9	10
E	1	A	1	A	2	2	L	1	2
Code 1 2		Code 3	Code 4	Code 5	Code 6	Code 7	Code 8	Code 9	Code 10
		Mfg. Year	Mfg. Month	Mfg. Date	Consecutive number		Special code		
Internal Tracing Code		2020-L 2021-M 2022-P 2023-Q ... 2026-T 2027-V ... 2030-Y 2031-Z ...	1:Jan. 2:Feb. ... A:Oct. B:Nov. C:Dec.	1:A 2:B 3:C ... 26:Z 27:7 28:8 29:9 30:3 31:4	01~ZZ		000~ZZZ		

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Specifications Range

■Luminous Intensity (Iv) :

Color	Spec. Range
R	80-160 mcd
G	180-260 mcd
B	30-70 mcd

Note: It maintains a tolerance of $\pm 10\%$ on luminous intensity

■Wavelength :

Color	Spec. Range
R	618-625 nm
G	520-535 nm
B	460-474 nm

Note: It maintains a tolerance of $\pm 0.5\text{nm}$ on Wavelength Bin

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Product Features

Electro-Optical Characteristics

(T_{Soldering} , 25 °C)

Series	Emitting Color	Material	Wavelength λ(nm)			I _v (mcd)
			λ _D	λ _P	Δλ	Typical
B3D83RGB	R	AlInGaP	624	630	18	65
	G	InGaN	523	518	35	85
	B	InGaN	470	465	25	20

Package Outline Dimension and Recommended Soldering Pattern for Reflow Soldering

(Unit: mm Tolerance: +/-0.1)

Outline Dim.	Soldering Pattern
<p>Soldering terminals may shift in the x, y direction.</p>	

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Absolute Maximum Ratings (unless otherwise specified, Temperature=25°C)

(T_{Soldering} 25 °C)

Characteristic	Symbol	Rating	Unit
Supply Voltage	VDD	6.5	V
Power Dissipation	PD	<400	mW
Maximum Output Current	I _{LEDOUT}	5	mA
Welding Temperature	TM	300(8S)	°C
Operating Temperature Range	TOPR	-40~85	°C
Storage Temperature Range	TSTO	-65~120	°C

Electrical Characteristics

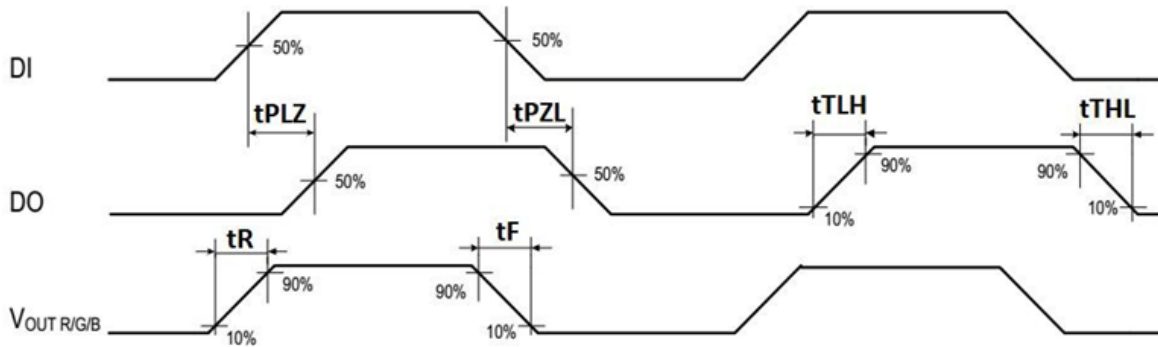
■Electrical characteristics

(Max., TA=25°C, VSS=5.0V)

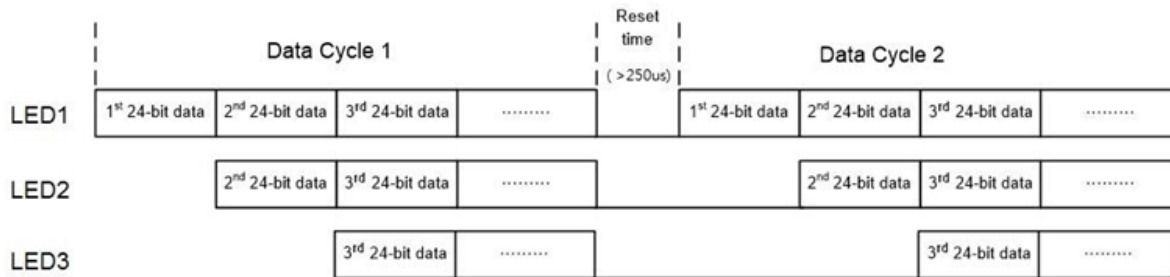
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VDD	3.3	5	5.5	V	
Operation Current	I _{DD}		1		mA	R/G/B without load
Sleep Mode Current	I _{sleep}		5		uA	
Input High "H" of DI, BI	V _{IH}	0.7*VDD		VDD+0.4	V	
Input Low "L" of DI, BI	V _{IL}	-0.4		0.2*VDD	V	
Output High "H" of DO	V _{OH}	4.5			V	I _{OH} =3mA
Output Low "L" of DO	V _{OL}			0.4	V	I _{OL} =3mA
R/G/B Sink Current	I _{SK}	2.9	3	3.1	mA	Max. 3mA option
		4.8	5	5.2	mA	Max. 5mA option
R/G/B Current Gain	G _{level}		3/17		mA/level	Max. 3mA option
			5/17		mA/level	Max. 5mA option
DI / BI Input Leakage	I _{leak}			1	uA	V _{DI} =V _{BI} =VDD=5V
R/G/B off Leakage Current	I _{off}			1	uA	V _{R/G/B} =5V, PWM off

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Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Propagation delay time	tPLZ			80	ns	DI → DO, load=30pF
	tPZL			80	ns	
Rising time	tTHL		15		ns	
Falling time	tTLH		15		ns	
Rising time	tR		50		ns	ISK(R/G/B) =3/5mA, load=30pF
Falling time	tF		50		ns	
Data rate	Fdata		800		KHz	

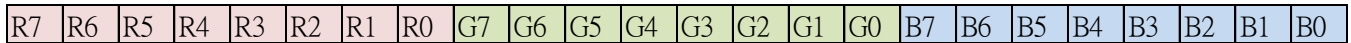


Data Transfer Protocol

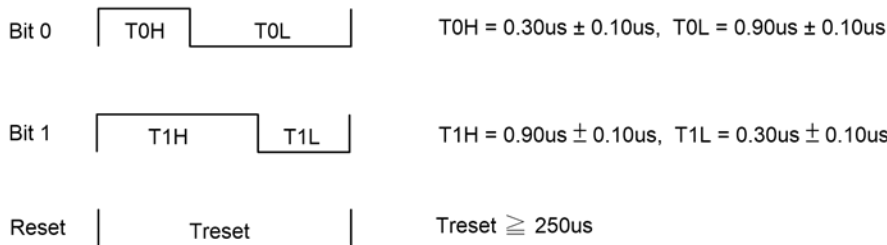


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The single wire data transfer protocol supports 24-bit data for each LED RGB display data refresh. B3D83RGB receives 24-bit data and passes the remaining data to next LED. The 24-bit data consist of green, red and blue data, each with 8-bit width, and are transferred with MSB first. Each of the 8-bit data determines 256-level PWM pulse used to control R/G/B channels.



The transferred data are recognized based on the pulse widths received by B3D83RGB. A low bit 0 is represented by a 0.3us high pulse followed by a 0.9us low pulse. A high bit 1 is represented by a 0.9us high pulse followed by a 0.3us low pulse. A low pulse $\geq 250\mu s$ is used to issue a reset command to B3D83RGB to start a new cycle of serial commands.



Sleep and power saving mode

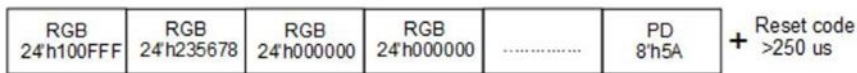
B3D83RGB supports sleep/wake-up modes for power-saving purpose. When receiving 24-bit 0's RGB data, 8-bit 0x5A special data, and a reset command, B3D83RGB will enter sleep mode. In sleep mode, the built-in oscillator and associated circuitry is disabled. The quiescent current of B3D83RGB is less than 2uA (typ.) in sleep mode.

A sleeping B3D83RGB wakes up from sleep mode when detecting an input rising edge on DI or BI pin. Normally a positive pulse on DI or BI pin can be used as a wake-up trigger. After waking up, all sleeping circuits in B3D83RGB return to normal working mode within 1ms. To wake-up the next cascaded B3D83RGB, the received positive pulse on DI pin is passed to DO pin, which connected to DI pin of the next B3D83RGB, and in turn wakes up the next B3D83RGB. Hence, all cascaded sleeping B3D83RGBs can wake up successively.

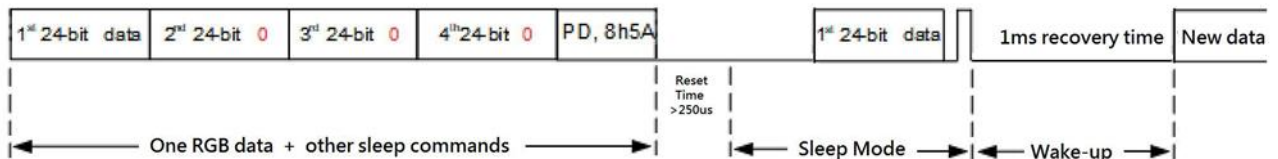
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Since it takes 1ms for a sleeping B3D83RGB returning to normal functioning mode, it is recommended for MCU to wait for 1ms to send display data and commands after issuing a wake-up pulse. In case a mal-functioned B3D83RGB exists in an LED strip, the one next to the mal-functioned B3D83RGB determines the sleep/wake-up mode through BI pin, instead of DI pin.

In an LED strip, it is possible to set certain B3D83RGBs active, while the others in sleep mode. As an example, the following commands are for two leading active B3D83RGBs and other sleeping B3D83RGBs.



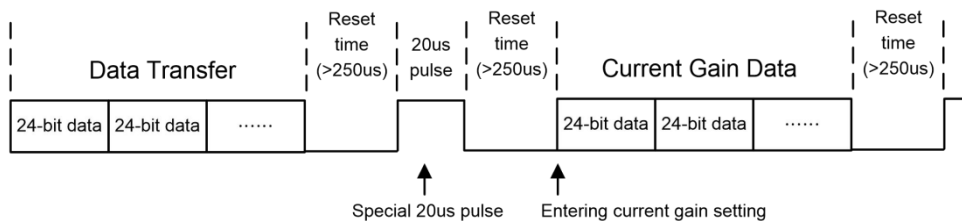
As an example of sleep/wake-up commands shown below, the first B3D83RGB is kept active and the remaining B3D83RGBs enter sleep mode by 24-bit 0's and an ending 0x5A byte. Later on, a positive pulse wakes up all sleeping B3D83RGBs.



Dimming Control

B3D83RGB supports an 16-level current gain control to adjust sink current of R/G/B channels. This feature enables dimming control of LED lighting. Each of the red, green and blue channels can be controlled individually, which in turn not only to save power consumption, but also to fine-tune the color temperature of R/G/B LEDs.

To set the current gain of B3D83RGB's R/G/B channels, a special pulse must be issued by MCU before setting the current gain levels, as shown below.



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After a reset pulse following normal data transfer, if a 20us positive pulse is issued with another reset pulse, B3D83RGB is forced into a special mode to interpret following 24-bit data as current gain setting data. Each of the 24-bit data comprises 4-bit gain values of R/G/B channels, as shown below.

S23	S22	S21	S20	S19	S18	S17	S16	S15	S14	S13	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
0	0	0	0	R[3]	R[2]	R[1]	R[0]	0	0	0	0	G[3]	G[2]	G[1]	G[0]	0	0	0	0	B[3]	B[2]	B[1]	B[0]

The maximum output current of each R/G/B channels is then determined as below ($I_{SK}=3mA$ or $5mA$).

$$R_{sink} = I_{SK} * (R[3]*10/17 + R[2]*4/17 + R[1]*2/17 + R[0]*1/17) \quad G_{sink} =$$

$$I_{SK} * (G[3]*10/17 + G[2]*4/17 + G[1]*2/17 + G[0]*1/17) \quad B_{sink} = I_{SK} *$$

$$(B[3]*10/17 + B[2]*4/17 + B[1]*2/17 + B[0]*1/17)$$

By default, $R[3:0] = G[3:0] = B[3:0] = 0x0F$.

Recommended programming flow:

After system power-on, MCU should send data 0 first (dark mode) for all LEDs in the strip, then MCU can deliver normal display data or execute current gain (dimming) command to LEDs.

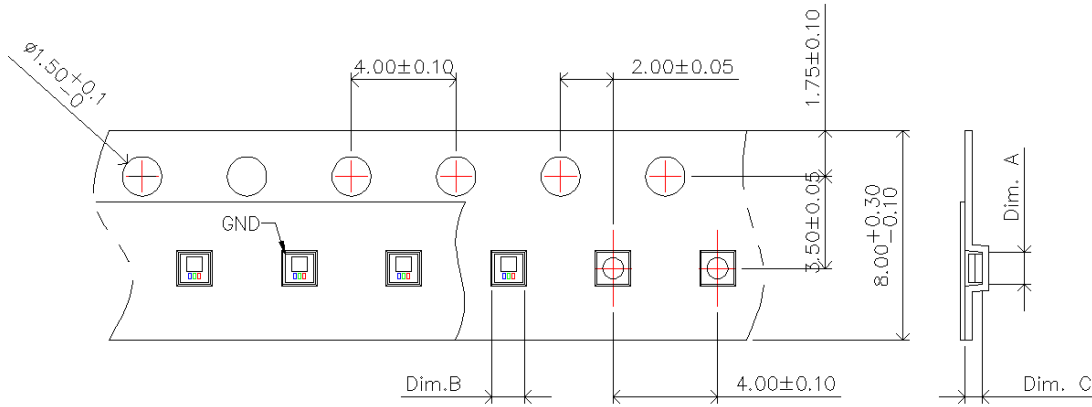
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Precaution for Use

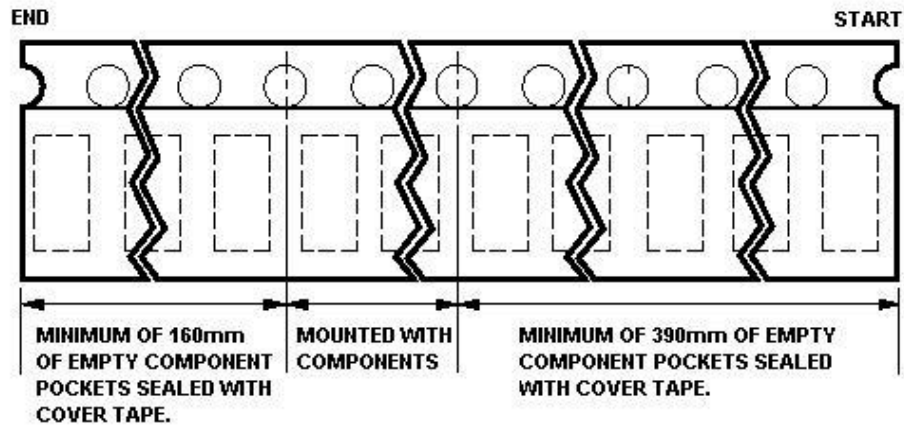
1. The chips should not be used directly in any type of fluid such as water, oil, organic solvent, etc.
2. When the LEDs are illuminating, the maximum ambient temperature should be first considered before operation.
3. LEDs must be stored in a clean environment. A sealed container with a nitrogen atmosphere is necessary if the storage period is over 3 months after shipping.
4. The LEDs must be used within 72hours after unpacked. Unused products must be repacked in an anti-electrostatic package, folded to close any opening and then stored in a dry and cool space.
5. The appearance and specifications of the products may be modified for improvement without further notice.
6. The LEDs are sensitive to the static electricity and surge. It is strongly recommended to use a grounded wrist band and anti-electrostatic glove when handling the LEDs. If a voltage over the absolute maximum rating is applied to LEDs, it will damage LEDs. Damaged LEDs will show some abnormal characteristics such as remarkable increase of leak current, lower turn-on voltage and getting unlit at low current.

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Packaging Tape Dimension

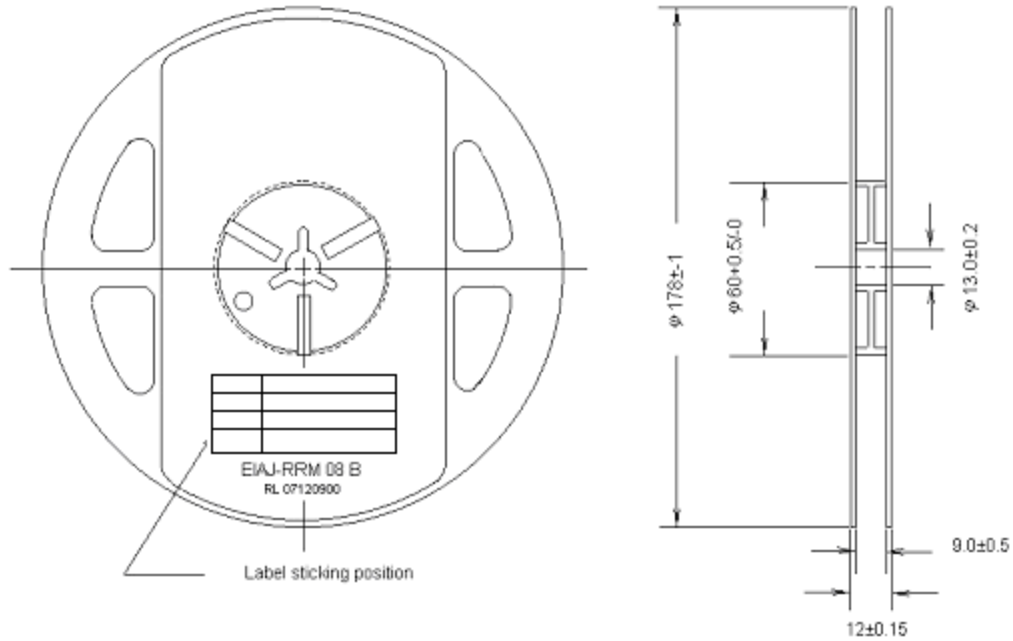


Dim. A	Dim. B	Dim. C	Qty/Reel
1.24±0.05	1.28±0.05	0.80±0.05	4K

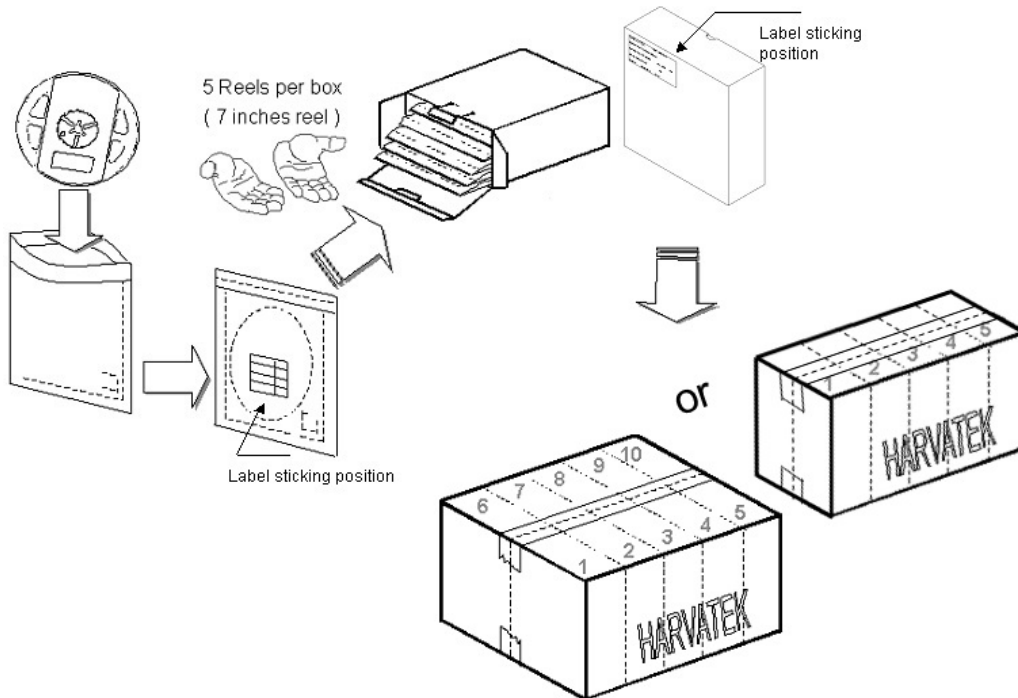


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Reel Dimension



Packing



5 or 10 boxes per carton is available depending on shipment quantity.

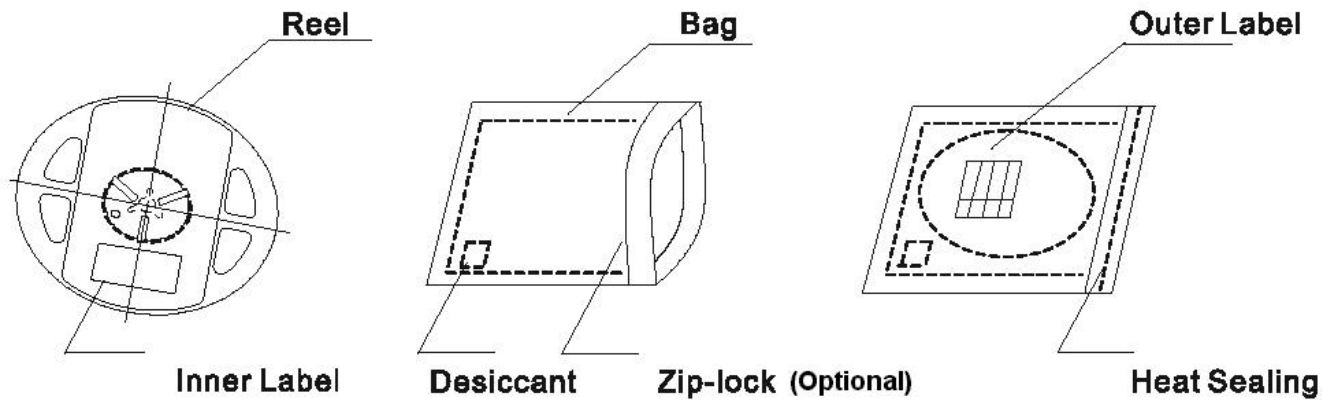
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Dry Pack

All SMD optical devices are **MOISTURE SENSITIVE**. Avoid exposure to moisture at all times during transportation or storage. Every reel is packaged in a moisture protected anti-static bag. Each bag is properly sealed prior to shipment.

A humidity indicator will be included in the moisture protected anti-static bag prior to shipment.

The packaging sequence is as follows:



Baking

Baking before soldering is recommended when the package has been unsealed for 72hours.

The conditions are as followings:

1. $60\pm 3^{\circ}\text{C} \times (12\sim 24\text{hrs})$ and $<5\%RH$, taped reel type.
2. $100\pm 3^{\circ}\text{C} \times (45\text{min}\sim 1\text{hr})$, bulk type.
3. $130\pm 3^{\circ}\text{C} \times (15\text{min}\sim 30\text{min})$, bulk type.

Precautions

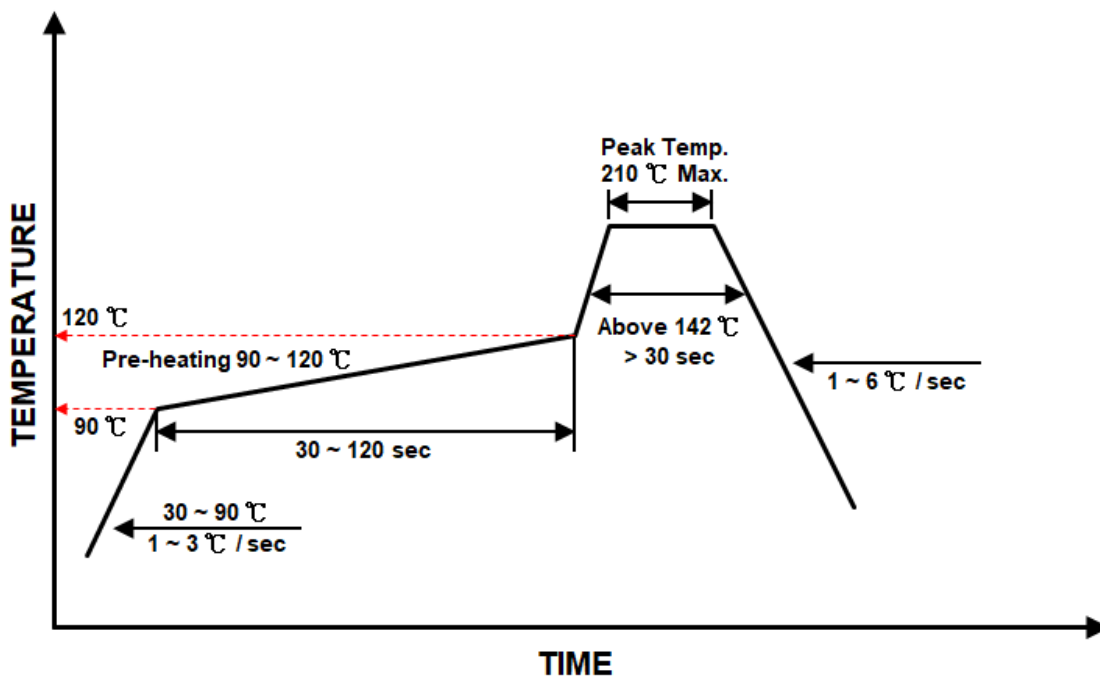
1. Avoid exposure to moisture at all times during transportation or storage.
2. Anti-Static precaution must be taken when handling GaN, InGaN, and AlInGaP products.
3. It is suggested to connect the unit with a current limiting resistor of the proper size. Avoid applying a reverse voltage beyond the specified limit.
4. Avoid operation beyond the limits as specified by the absolute maximum ratings.
5. Avoid direct contact with the surface through which the LED emits light.
6. If possible, assemble the unit in a clean room or dust-free environment.

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Reflow Soldering

Recommend soldering paste specifications:

1. Operating temp.: Above 142°C , >30sec
2. Peak temp.:210°C Max.
3. Never take next process until the component is cooled down to room temperature after reflow.
4. The recommended reflow soldering profile (measuring on the surface of the LED terminal) is following: Lead free Solder Profile
5. Reflow soldering should not be done more than two times



Reworking

- Rework should be completed within 5 seconds under 210°C.
- The iron tip must not come in contact with the copper foil.
- Twin-head type is preferred.

Cleaning

Following are cleaning procedures after soldering:

- An alcohol-based solvent such as isopropyl alcohol (IPA) is recommended.
- Temperature x Time should be 50°C x 30sec. or <30°C x 3min

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- Ultrasonic cleaning: < 15W/ bath; bath volume ≤ 1liter
- Curing: 100 °C max, <3min

Cautions of Pick and Place

- Avoid stress on the resin at elevated temperature.
- Avoid rubbing or scraping the resin by any object.
- Electric-static may cause damage to the component. Please ensure that the equipment is properly grounded. Use of an ionizer fan is recommended.

Revise History

Rev.	Descriptions	Date	Page
1.0		12/01/2022	

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